# Product Development Team
# for
# NEXRAD Enhancements

## Quarterly Report – 1st Quarter FY 01

### 01.6.1 Damaging Winds

*Development and enhancement of the Damaging Downburst Detection and Prediction Algorithm (DDPDA) to ensure that it meets the aviation communities' needs for the prediction and detection of damaging winds associated with both wet and dry atmospheric environments, along with larger scale downbursts.*

a) Current Efforts

Transfer of DDPDA to the Open Systems Platform continues

Appropriate data sets for polarimetric analysis have been identified. The data tapes are currently being collected and examined.

b) Planned Efforts

Begin examination of polarization data and downburst signatures.

c) Problems/Issues

None.

d) Interface with other Organizations

None.

e) Activity Schedule Changes

None.

### 01.6.2 Polarization and Frequency Diversity

*Continue development of algorithms that utilize polarization data to detect and predict the movement of the volumetric extent of hydrometeors such as hail, rain, snow, sleet, icing conditions, and freezing rain that are hazardous to aircraft.*

a) Current Efforts

(NSSL): Ms. Yidi Liu, who has been developing and testing the hydrometeor classification algorithm, departed NSSL on 5 January 2001. Therefore, much of the work in this quarter was spent documenting the software. More testing of the algorithm was performed, and the results were incorporated in the revision

of the paper “Testing a procedure for automatic classification of hydrometeor types”. A replacement for Ms. Liu has been identified from within current staff, and is being familiarized with the software and tasks.

(NCAR): Analysis of vertical profiles of polarimetric radar measurements (reflectivity, differential reflectivity, linear depolarization ratio, and correlation coefficient) obtained at vertical incidence and from scanning is continuing.

The data are being used in large part to study the changes in hydrometeor particle properties as they descend to and fall through the melting layer. Examination of the data reveals that snow particle fall speeds are often higher than in published studies, suggesting high density particles probably formed by riming. Interestingly, there is much scatter between the solid particles entering the melting layer and the rain below.

Detailed analyses are being performed with polarimetric measurements obtained in Kansas (the STEPS Experiment). The melting layer heights are being computed on dense spatial grids. Estimated heights are quite stable, suggesting that the melting layer can be determined quite accurately. Additional data sets with concurrent freezing level heights and radar measurements are needed.

The S-Pol radar is currently deployed near Seattle, WA, as part of the IMPROVE Project. Both tilt and vertical data at high resolution are being acquired. Of particular importance are the large number of soundings being taken (often at 2 to 4 hour intervals). These data will be used to verify the radar estimates of the freezing level. Also, in situ particle measurements are being obtained for further verification of the real-time particle designations being made with S-Pol.

b) Planned Efforts

NSSL: Continue training of new personnel and continuation of statistical analysis.

NCAR: Continue the work on a freezing level algorithm and the verification of particle designations using the Florida data sets.

None.

d) Interface with other Organizations

None.

e) Activity Schedule Changes

None.

### 01.6.3 Circulations

*Continue to enhance NSSL's Mesocyclone Detection and Tornado Detection Algorithms (MDA, TDA) while developing in parallel a new algorithm which combines MDA and TDA into one algorithm which detects and analyzes all circulations - the Vortex Detection and Diagnosis Algorithm (VDDA).*

a) Current Efforts

The TAC has recommended that MDA be included in the next Open Build. Efforts have focussed on the transfer of MDA in to the Open Build environment.

Data sets are being prepared for a statistical analysis of MDA/TDA data to determine what combination of parameters will provide ITWS with better severe storm guidance. One data set (from Pittsburgh, PA) is complete. Data from the St. Louis, MO, NEXRAD is being compiled.

b) Planned Efforts

Continue compilation of St. Louis, MO, data. Perform statistics on indicators that tend to be best associated with severe thunderstorm reports.

c) Problems/Issues

None.

d) Interface with other Organizations

None.

e) Activity Schedule Changes

Milestone 00.6.3.E1 was to be accomplished 3 months after OSF acceptance of MDA. Because OSF acceptance is contingent upon TAC approval, this deliverable date will be reviewed now that the official TAC recommendation is known.

### 01.6.4 Technical Facilitation

*Continue to work through the process of algorithm transition to the operational WSR-88D system. This also includes development of a Common Operations Development Environment (CODE) and Application Programmer Interfaces (API's) for a more rapid integration of algorithms into the operational system.*

a) Current Efforts

The display of trends and tables was improved, so that they can be configured by a user, even for new developmental products. The trend infrastructure was improved for this purpose. AMBER trends and tables are now integrated into the system.

Work was performed to be able to release CODE as a binary release. This work is complete. This frees users from building 88D-CODE from scratch.

The interactive cross-section capability has been implemented. It is now possible to interrogate and "fly through" a storm, and to view high-resolution cross-sections of the data. A paper describing the technique is being written.

Product selection was improved to be consistent among all the data sources (RIDDS, netcdf, ORPG) that CODE currently supports. Algorithm developers now have a consistent interface to access base data from all of these sources, and to wait for new products. For future flexibility, all the configurations are being done using XML.

b) Planned Efforts

c) Problems/Issues

None.

d) Interface with other Organizations

None.

e) Activity Schedule Changes

None.

### 01.6.6 Rapid Update

*Develop software that produces algorithm output after each tilt, thus providing immediate information to the users.*

a) Current Efforts

Ms. Yidi Liu was responsible for the integration of Rapid Update within CODE. This task was technically complete at the end of FY 00. However, enhancements were needed to make Rapid Update behavior operationally optimal and to resolve some long-standing ambiguities.

For MDA and TDA, the motion vector is now calculated, and tracking is performed, after a new low-altitude single 2D feature is time-associated with an old 3D detection. The tracking results are now output as they change, without any need to wait for a new volume scan.

For MDA, the time associations for detections whose base are above lowest elevation angle is now performed.

For MDA, vertical association for 2D features at ranges greater than 175 km is now performed in the same way as 2D features at ranges less than 175 km. Previously, 2D features beyond 175 km were treated as a special case, in that no vertical association was performed. These changes are implemented into the SSAP code.

b) Planned Efforts

1. Bring new personnel up to speed on rapid Update code.

2. Prepare for real-time testing.

None.

d) Interface with other Organizations

None.

e) Activity Schedule Changes

None.

### 01.6.7 Cell and Area Tracking

*Integration of the Storm Cell Identification and Tracking (SCIT), the Correlation Tracking (CT) and Scale Separation (SS) algorithms into a single multi-scale precipitation tracking and forecast package.*

a) Current Efforts

The latest update to the Growth and Decay Storm Tracker (GDST) software was obtained from MIT/LL and compiled into a working version. Several cases of Archive Level II data that contain different types of convection were also obtained. Vertically Integrated Liquid (VIL) fields for each case were obtained from the Archive Level II data and converted to the GDST native “CAR” format. GDST and NSSL's Storm Cell Identification and Tracking (SCIT) algorithms were run on data from all the cases. Output from the GDST algorithm was converted to a format necessary for display in NSSL's “RADS” display system. Output from the two algorithms will be compared for approximately 40 hours worth of Archive Level II data.

b) Planned Efforts

Provide a clean display of SS/CT output for a given forecast time overlaid with SCIT cell motion, such that users can immediately discern the difference between area and cell motion.

c) Problems/Issues

None.

d) Interface with other Organizations

None.

e) Activity Schedule Changes

As yet, it is unclear how much effort will be required to implement the GDT into CODE; milestones and/or funding may need to be reviewed.

**01.6.9 Composite Products**

*Develop high resolution radar layer products that are rapidly updated.*

a) Current Efforts

Activities for the first quarter include finalizing radar integration and gridding procedure. The C++, object-oriented, coding of the 3D reflectivity mosaic algorithm is complete. The algorithm is further optimized by eliminating all repetitive computations and by using lookup tables instead. This change has saved the CPU time by more than 70% and the clock time by more than 50%.

An AP removal algorithm using Doppler velocity fields is under investigation. Testing of the AP removal product commences next month.

b) Planned Efforts

The main focus during the next quarter will be to test a new AP removal algorithm using Doppler velocity fields.

c) Problems/Issues

None.

d) Interface with other Organizations

None.

e) Activity Schedule Changes

None.

**01.6.11 Volume Coverage Patterns**

*Develop and implement Volume Coverage Patterns (VCP's) relevant to the goals of the AWR PDT's.*

a) Current Efforts

Experimental VCP data was collected on the following dates:

KCRI-100500 Rain event, collected VCP 56 & 57.
KCRI-101300 Rain event, collected VCP 57.
KCRI-101500 Rain event, collected VCP 59.
KCRI-102200 Heavy rain event, collected VCP 59.
KCRI-102700 Severe event w/ heavy rain, collected VCP 57.
KCRI-102800 Squall line, collected VCP 57.
KCRI-110300 Stratiform rain event, collected VCP 56.
KCRI-110700 Rain/snow mix, collected VCP 56.
KCRI-110800 Snow event, collected VCP 56.
KCRI-121200 Snow/sleet/freezing rain event, collected VCP 56.

b) Planned Efforts

Continue analysis and data collection on new VCP's. In particular, check that current algorithms are compatible with new VCP's, and correct any incompatibilities.

c) Problems/Issues

None.

d) Interface with other Organizations

None.

e) Activity Schedule Changes

None

**01.6.12 Product Implementation**

*Explore and define implementation paths within the aviation community systems that are best for NEXRAD PDT products.*

a) Current Efforts

None.

b) Planned Efforts

Coordinate new SSAP installation for MIT/LL and coordinate testing of MDA output on known cases.

Coordinate with NCAR on their freezing level identification algorithm, then present this capability to other PDT's to determine interest levels.

A specific meeting with AWC is planned to discuss the current suite of NEXRAD products and how current NEPDT products can be implemented.

c) Problems/Issues

None.

d) Interface with other Organizations

None.

e) Activity Schedule Changes

None

**01.6.14 Multi-radar Composites**

*Develop a vision for FAA use of high resolution, rapid update, composite products which are produced from the integration of multiple WSR-88Ds.*

a) Current Efforts

Work on this effort has not yet started. The study on feasible and scientific means of multi-radar velocity integration will start 1 January 01.

b) Planned Efforts

The main focus during the next quarter will be literature reviews on Doppler velocity analysis and integration.

c) Problems/Issues

None.

d) Interface with other Organizations

None.

e) Activity Schedule Changes

This task has been modified to suit the available funding.